

13. On the Skeleton and Lineage of *Fregilupus varius*.

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(Plates LXI. & LXII.)

HISTORY OF THE BIRD.

Preliminary Remarks.—By the zeal for ornithology and the urbanity of Prof. Newton, I am stimulated to render a more ample account of the skeleton of *Fregilupus* belonging to him, and briefly commented on by me in the 'Ibis' of 1873*. As therein mentioned, there is no representative of the type, in skin or otherwise, in England of this singular so-called Madagascar form, save the skeleton in question. The literature of its anatomy is confined to my own curt osteological remarks. I now figure the mounted skeleton, of natural size, and in addition, in a second Plate, such characteristic sketches of the separated bones as may better enable comparisons to be instituted.

This specimen (as I am informed), was given to Prof. Newton by the late M. Jules Verreaux, who said that he shot the bird from which it was preserved in the island of Réunion many years since (1832?). The species is now to all appearance extinct, and, notwithstanding what has been said of it, seems to have been confined to that one island. The fact is that, if *Fregilupus* is not quite extinct, it evidently is fast becoming so; for recent writers aver it is no longer to be obtained in its old haunts, and somewhere about twenty years have elapsed since any thing positive concerning its existence has been authenticated†. Thus I am the more impressed with the necessity for a published record accompanied by osteological illustration. If, as is to be feared, before long it shall be looked upon as a bird of the past—gone like the Dodo, Solitaire, Aphanapteryx, &c.—then it would be a pity to let the present opportunity slip. Moreover this skeleton and another said to have been deposited in the Paris Museum, having both been procured by an ornithologist of reputation and prepared by his own hands, have a stamp of certainty about them enhancing their value. This extreme paucity of material, and possibility of no future supply, may yet render them invaluable historical examples, marking the progress of avian extinction in the Mascarene Islands.

Original observations pertaining to the bird are few and not very satisfactory in substance. Indeed I find nearly all the travellers' accounts to be but a repetition of the earlier imperfect notices, these same being looked upon rather suspiciously by those best qualified to estimate their worth. For the sake of bringing within easy compass the known history of *Fregilupus*, I insert in

* "On the *Upupidae*," *tom. cit.* p. 200.† *Vide* footnote from Schlegel, p. 479.



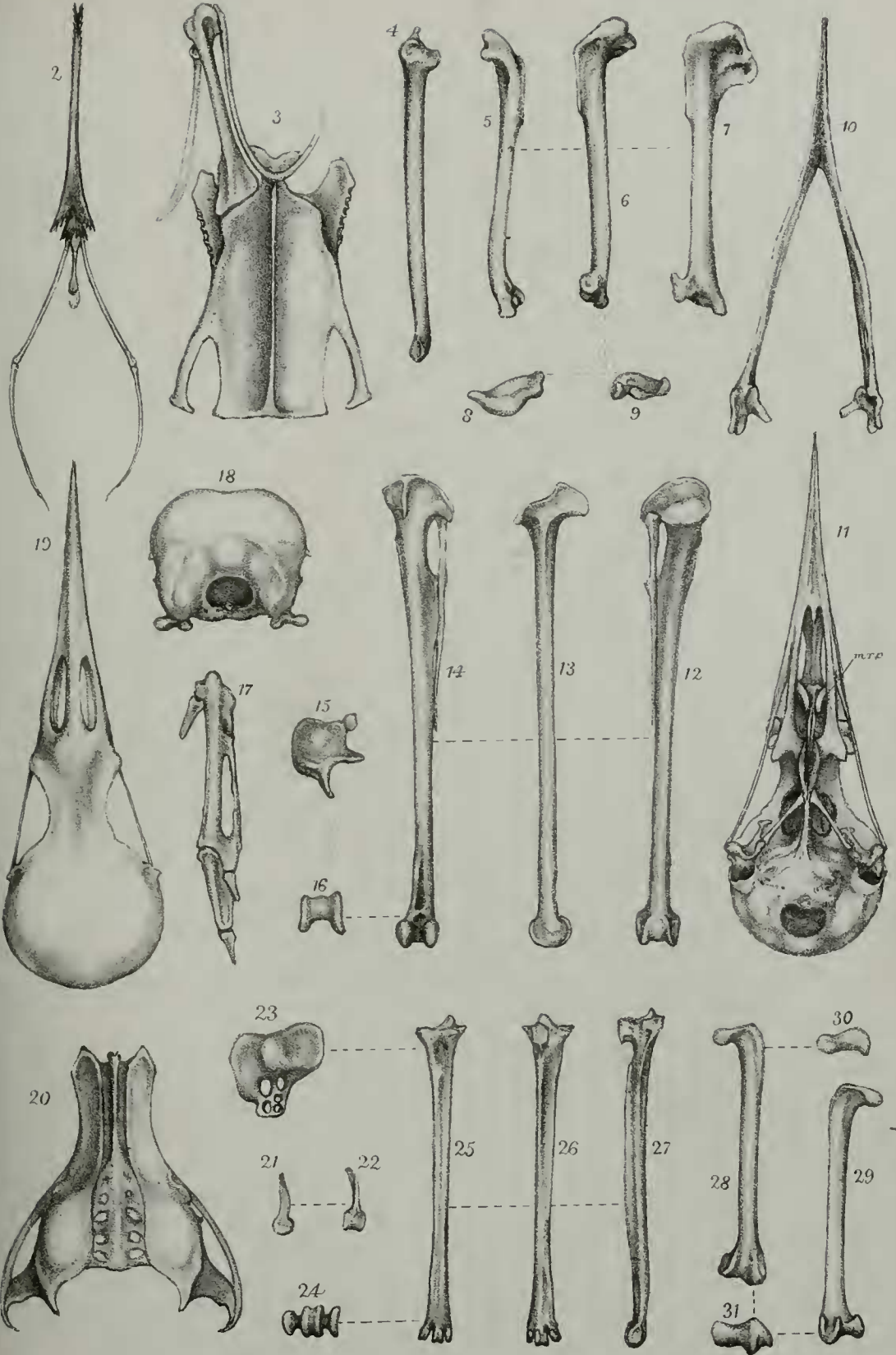
Fig. 1.

FREGILUPUS VARIUS ♂

Haubart imp

Berjeau lith





Berjeau lith

Harshart imp

FREGILUPUS VARIUS. ♂.



footnotes the bulk of the published data. Thus drawn up in rank and file, the gaps are conspicuous. If a credible and thoroughly reliable estimate of the bird, its local range, &c. is ever to be obtained, the subjoined wants and hints may, I trust, be found appropriate and useful as passing memoranda.

Desiderata.—

1. Whether *Fregilupus* was absolutely restricted to Réunion or where else with certainty it has been found.

2. Whether it is still alive on Réunion or elsewhere, and the locality where found, personal and second-hand information being duly noted.

3. Any documents proving the last date when observed.

4. By what means coastwards is it supposed to have become rare, or the steps and progress of its extinction. Has the introduction of the common Indian Mynah, by diminishing its food, tended to reduction? or has man been the suppressing agent?

5. All data connected with its habits would be invaluable, especially the nature of its food, nest-building, colour and number of eggs.

6. Any account of successive change of plumage or variety in the feathering of the young and in sexual development.

7. If any specimens are ever procured, it is most important that one or more of these, at different ages and sexes if possible, be preserved entire in spirits or otherwise, so that the internal anatomy, pterylosis, &c. may be accurately ascertained by those competent to the task.

8. If a preservative solution is not at hand, by simply slitting up the belly without injuring the internals, filling this with salt or placing the entire specimen in salt or sugar, it will be saved. If these cannot be procured, drying the body complete in a current of air or in the shade so that it becomes thoroughly hardened will effectually prevent decomposition, remembering, however, that it must afterwards be kept free from damp and the attacks of insects in its transmission.

Synonymy and Figures.—

FREGILUPUS VARIUS (Boddaert).

? "*Tiuouch*," Flacourt, Hist. d. l. Grande I. Madag. p. 166 (1658).

La Huppe noire et blanche, du Cap de Bonne Espérance, De Montbeil. in Buffon, Hist. Nat. vi. p. 463 (1779).

Madagascar Hoopoe, Latham, Gen. Synop. i. pt. ii. p. 690 (1782).

La Huppe du Cap de Bonne Espérance, De Montbeillard, Pl. Enl. 697 (1783).

Upupa varia, Boddaert, Tabl. Planch. Enlum. p. 43 (1783).

Upupa capensis, Gmelin, Syst. Nat. i. p. 466 (1788).

La Huppe grise, Vieill. Ois. Dorés, i. (Hist. d. Promérois) p. 12, tab. 3 (1802).

Le Mérops Huppé, Levaill. Ois. d. Parad. iii. (II. N. d. Promér. et Guép.) p. 43, tab. 18 (1807).

Upupa madagascariensis, Shaw, Zool. viii. p. 140 (1811).

La Huppe du Cap (*Upupa capensis*), Cuv. Règ. An. i. p. 407 (1817).

Coracias tivouch, Vieill. Nouv. Dict. d'Hist. Nat. viii. p. 3 (1817).

Coracia cristata, Vieill. Tab. Encl. 697 (1823).

Pastor upupa, Wagler, Systema Avium, p. 90 (1827).

Fregilupus capensis, Less. Traité Ornith. i. p. 324 (1831); Bonap. Consp. Gen. Av. p. 88 (1850).

Fregilupus madagascariensis, Reich. Hand. d. sp. Ornith. p. 321, t. 596. fig. 4039 (1851); Hartlaub, Orn. Beitr. z. Faun. Madag. p. 53 (1861); Schleg. Recher. Faun. Madag. p. 104 (1868); Giebel, Thesaurus, p. 627 (1874).

Fregilupus borbonicus, Vinson, Bull. Soc. Acclim. p. 627 (1868); Giebel, Thesaurus, p. 627 (1874).

Fregilupus varia, Gray, Hand-list of Birds, pt. ii. p. 28 (1870).

Lophopsarus, Sundevall, Meth. Nat. Av. Disp. Tent. p. 40 (1873).

The illustrations representing this rare Bourbon bird, as well as I can judge, are limited to two originals, De Montbeillard's and Levillant's. Which is most to be depended on it is hard to say, though the concurrent testimony of Hartlaub, in his description from well-preserved skins, renders it probable that Levillant's figure is, on the whole, the most natural and truthful. Vieillot's figure, one would suppose, is a modification of De Montbeillard's, but with a bright blue iris, more highly worked in the feathering, and with a wing-tint intermediate between De Montbeillard's slate-colour and Levillant's chestnut hue. It would seem as if Vieillot's artist had taken the published engraving as his model, the colouring possibly from a museum skin, and for the eyes was indebted to his imagination. Reichenbach's (a copy of course) is a very much reduced outline of Vieillot's, partly coloured after all three figures. Somehow or other, none of the figures extant seem to me a natural representation; there is a crude stiffness in the crest, and other detail by no means life-like.

Views promulgated and Historical Survey.—In Flacourt's* list of the fauna of Madagascar a few words in mention of a bird named "Tiuouch," or, according to modern typography, "Tivouch" (not Tinouch and Tirouch, as some subsequent writers spell it) are regarded as the earliest notice of our form. But the identification of this with that now known as *Fregilupus* is very obscure; and some ornithologists (see Newton's remarks, p. 479) have grave doubts thereon. Buffon's † "*La Huppe noire et blanche, du Cap De Bonne*

* The following is literally all said by the old voyageur and Directeur général de la Compagnie François de l'Orient:—"Tiuouch c'est la huppe, il est tacheté de noir et de gris, et a une belle crest de plume."—De Flacourt, 'Hist. d. l. Grande isle Madagascar,' Paris (1658), p. 166.

† This gifted and florid writer, in his 'Histoire Naturelle,' says:—"Cet oiseau diffère de notre huppe et de ses variétés, par sa grosseur; par son bec plus court et plus pointu; par sa huppe, dont les plumes sont un peu moins hautes à proportion, d'ailleurs effilées à peu près comme celles du coucou huppé de Madagascar; par le nombre des pennes de sa queue, car elle en a

Espérance," with description, and De Montbeillard's figure thereof, may therefore be looked upon as the first account of the bird worthy of credence. Latham's reference is nothing more than a modified translation of the preceding French author. Boddaert's few words stamp specific distinctness according to the present acknowledged mode of scientific nomenclature. Levaillant* led the van in an-

douze; par la forme de sa langue qu'est assez longue, et dont l'extrémité est divisée en plusieurs filets; enfin, par les couleurs de son plumage. Il a la huppe, la gorge et tout le dessous du corps, blancs sans tache; le dessus du corps, depuis la huppe exclusivement jusqu'au bout de la queue, d'un brun dont les teintes varient et sont beaucoup moins foncées sur les parties antérieures; une tache blanche sur l'aile; l'iris d'un brun bleuâtre; le bec, les pieds, et même les ongles, jaunâtres.

"Cet oiseau, se tient dans les grands bois de Madagascar, de l'île Bourbon et du cap de Bonne Espérance. On a trouvé dans son estomac des graines, des baies de *pseudo-buxus*. Son poids est de quatre onces; mais il doit varier beaucoup, et être plus considérable aux mois de juin et de juillet, temps où cet oiseau est fort gras.

"Longueur totale, seize pouces; bec, vingt lignes, très-pointu, le supérieur ayant les bords échancrés près de la pointe et l'arête fort obtuse, plus long que l'inférieur, celui-ci tout aussi large; dans le palais, qui est fort uni d'ailleurs, de petites tubérosités dont le nombre varie; narines comme notre huppe; les pieds aussi, excepté que l'ongle postérieur, qui est le plus grand de tous, est très-crochu; vol, dix-huit pouces; queue, quatre pouces dix lignes, composée de plumes à peu près égales, cependant les deux intermédiaires un peu plus courtes, dépasse d'environ deux pouces et demi les ailes, qui sont composées de dix-huit plumes."

* The Count's countryman, Levaillant, proceeds as here quoted at length:--
 "Le *Merops huppé*.—Buffon a décrit et figuré cet oiseau sous le nom de huppe noire et blanche du Cap de Bonne Espérance (no. 697 de ses planches enluminées); cependant, d'après ce qu'il en dit lui-même, il auroit du voir que cette espèce ne pouvoit être comprise dans le genre de notre huppe. Un oiseau qui en effet a la mandibule supérieure du bec échancrée du bout, la langue cornée, pointue, divisée en plusieurs filaments, et de la longueur à-peu-près du bec; qui a les pieds extraordinairement forts, relativement à sa taille, et les ongles grands et arqués, quoiqu'il dise qu'ils sont semblables à ceux de notre huppe, et qui enfin se nourrit de fruit, n'est bien certainement pas un oiseau qui appartienne au genre de la huppe, ni à celui des autres promérops, qui tous ont des caractères très-différents, comme on l'a vu, et ne se nourrissent que d'insectes. Pourquoi encore nommer cet oiseau *huppe noire et blanche*, lorsqu'il n'a pas un atome de noir dans son plumage, ainsi qu'on le voit, aux restes d'après la description que Buffon donne lui-même de ses couleurs, qui sont, comme il le dit, d'un blanc pur sur la huppe, dont toutes les plumes sont très-éfilées sur la tête et tout le dessous du corps, y compris les couvertures du dessous de la queue? Le manteau est d'un brun clair et comme poudreux, plus foncé sur le dos et les ailes, marquées de blanc vers le milieu de leurs plumes. Le croupion et la queue, qui est carrément coupée du bout, sont de la couleur des ailes. Le bec, les pieds et les ongles sont d'un jaune citron, ainsi que la langue et le dedans de la bouche.

"Buffon assure que cet oiseau se trouve aux îles de France, à Madagascar, et au Cap de Bonne Espérance; mais ce qu'il y a de certain à cet égard c'est que je ne l'ai rencontré dans aucun des cantons du continent d'Afrique que j'ai parcourus, et qu'un habitant de l'île Bourbon m'a assuré que l'espèce y étoit très-abondante, qu'elle vivoit en grandes bandes, fréquentoit les lieux humides, les marais; qu'on l'y nommoit Martin [= *Pastor*] et qu'elle faisoit beaucoup de dégât aux cafiers, dont elle étoit très-avide du fruit; ce qui prouveroit que cet oiseau doit avoir montré aux habitants beaucoup d'analogie avec les autres oiseaux auxquels on donne généralement dans l'Inde le nom de Martin, pour qu'il en ait reçu le même nom. Pour peu, au reste, qu'on veuille faire

nouncing scepticism towards Buffon's notion of its being a Hoopoe ; but this enthusiastic African traveller and naturalist himself, notwithstanding, thrust it into suspicious companionship. Whilst Vieillot* saw fitness to class it with the Choughs, Wagler, more sagaciously, conceived it to be a kind of Cow-bird or species of *Pastor*. Lesson gave it a new generic title, but retained it in his family "Les Upupées," embracing *Epimachus*, *Ptilorhis*, *Falycinellus*, *Promerops*, *Upupa*, *Fregilupus*, *Fregilus*, and *Corcorax*. Bonaparte adopted Lesson's appellation, detaining the genus in his restricted group of Upupidæ, the Bucerotidæ treading on the heels of *Fregilupus*. Hartlaub†, who evidently made a careful

attention, en comparant cet oiseau aux Mainates [=Mynahs] et aux différentes espèces connues sous le nom de Martin, ou saisira d'abord et du premier coup d'œil l'analogie qu'il montre avec ces derniers, dont il a toutes les formes extérieures, à la seule différence près du bec, qui est ici plus allongé et un peu arqué, mais qui n'en a pas moins pour cela beaucoup de rapport avec celui des Martins. Au reste, cet oiseau étant très commun aux îles de France, il faut espérer que quelques voyageurs nous apprendront un jour son histoire ; ce qui déterminera positivement sa place dans la série des êtres.

"J'ai vu jusqu'ici huit individus de cette espèce ; deux dans notre Muséum de Paris ; les autres dans les cabinets de MM. Gigot Dorcy, Mauduit, l'Abbé Aubrey, Poissonnier ; un chez mon M. Raye, à Amsterdam, et enfin le dernier fait partie de ma collection. N'ayant remarqué aucune différence sensible entre tous ces individus, il est probable qu'il n'y en a pas beaucoup peut-être dans les sexes ; à moins cependant qu'ils ne fussent tous du même ; ce qu'il seroit difficile de penser."—*Ois. d. Parad.* iii.

* M. Vieillot, as the author of the ornithological paragraph in the *Nouv. Dict. d'Hist. Nat.*, under *Coracias* alludes to Buffon's bird. Besides the facts already known, he remarks:—"Comme on l'a jusqu'à présent classé avec le puput et les *promérops*, on me reprochera, peut-être, de l'avoir déplacé pour le mettre dans autre genre. Cependant ce n'est ni un puput ni un *promérops* ; et la *Coracias* [=Chough] est l'oiseau dont il se rapproche le plus, par son bec, garni, à la base, de petites plumes dirigées en avant, et couvrant presque entièrement les narines ; caractère qui a donné lieu à M. Cuvier de dire (article des huppées du Règne Animal) que 'cet oiseau se lie plus particulièrement au craves [=Rollers], parce que les plumes antérieures de sa huppe, courtes et fixes, se dirigent en avant et couvrent les narines ;' en effet, ce caractère n'existe point chez notre huppe ou puput, ni chez les *promérops* ; de plus le *tivouch* diffère de la huppe, en ce qu'il a douze pennes à la queue, et la langue d'une longueur ordinaire ; tandis que chez le puput, la queue n'est composée que de dix pennes ; et que la langue est très-courte, obtuse et très-entière ; ces deux attributs, joints à celui des narines, m'ont paru suffisans pour le retirer du genre *Upupa* ; il se rapproche davantage des *promérops* qui ont, dit-on, la langue presque aussi longue que la bec et douze pennes à la queue ; mais ceux-ci ont les narines découvertes et les plumes du *capistrum* nullement couchées sur le bec. Les *coracias* étant donc les seuls qui présentent la réunion des attributs du *tivouch*, je me suis déterminé à le placer dans leur genre ; cependant, si, comme le dit Montbeillard, sa langue est divisée par plusieurs filets à son extrémité, ce caractère ne se trouve point chez les *coracias*, dont la langue est seulement bifide à la pointe."—*Tom.* viii. p. 3.

† I select and partly translate such of Hartlaub's observations as properly form an historical appendix to the preceding extracts:—

"FREGILUPUS, Less.—*Fr. madagascariensis* (Sh.). *Crista erecta alta, compressa, e plumis strictis subantorsum versis composita, albida, nigricante infumata ; tibiis, dorso, alis et cauda dilute fuscis ; macula parva speculari alba ; collo et gastræo toto albis, illo supra subgriseo ; abdomine imo et subcaudalibus pallide fusciscentibus ; subalaribus niveis ; uropygio et tectricibus caudæ*

study of the bird in skin, placed it among the Sturnidæ alongside of *Hartlaubia*. Schlegel* has indorsed the latter position in his ornithological contribution to MM. Pollen and Van Dam's work on 'The Fauna of Madagascar and Dependencies;' and I find him stating, in an earlier popular treatise†, that it is a kind of Starling. In the 'Genera of Birds,' G. R. Gray allows that the *Fregilupus* of Lesson may be a *Upupa*; but in his later 'Hand-list' he has totally altered this opinion, and made it come last in the subfamily Juidinæ, the Icteridæ having successive proximity. Lastly, and anew, Sundevall acquiesces in its Pastorine affinities, but in the light of an old friend with a new garb.

With reference to the Cambridge skeleton, I may here insert a note concerning it from Prof. Newton, to whom I had transmitted my drawings with the name *Fregilupus madagascariensis* upon them. He writes me:—"I am afraid I have led you astray as to the specific name of the bird. There is no doubt, I think, of its being the *Upupa varia* of Boddaert, whose specific name has accordingly priority of

superioribus subrufescentibus; rostro longiuseculo, gracili, subarcuato, acuto, pedibus et orbitis flavis, unguibus fuscis. Long. circa 10", rostr. 1" 8", al. 5" 5", caud. 3" 9", tars. 1" 6", dig. med. 9",

Then follows synonymy. "*Hab.* Madagascar, Bourbon, Isle of France."

He further observes:—"In collections it is always of the greatest rarity. Wanting, for example, in the rich Museums of Vienna, Berlin, and Dresden. In Leyden, old and poor. Very beautiful and fresh in Florence and Pisa: three examples from Madagascar. Also in Stockholm. The assertion of Bowdich, that '*Upupa capensis*' has been got at Porto Santo, arises naturally from a mistake (*Excurs. Port. Sant. & Madeira*, p. 93). [Here it may be stated that there is also a specimen in the Museum at Port Louis, Mauritius.—*Newton*.]

"I measured a beautiful new specimen in the Paris Museum from Bourbon. Entire length 11½", beak 13½", wing 5" 7", tail 4" 10", tarsus 1" 5½". The only true systematic place of this bird is that long ago adjudged to it by Temminck and Wagler [that is, among the Pastors, though Hartlaub is wrong in quoting Temminck as an authority. See footnote p. 487].

"In this place I call attention to the known matter of fact, that the Indian *Aceridotheres tristis* [Common Mynah] has, a long time since, been introduced into Mauritius and become domesticated. This species there also proves itself an indefatigable extirpator of grasshoppers &c."—*Ornith. Beiträge z. Fauna Madag.* pp. 53 & 54.

* Professor Schlegel's memorandum bears intrinsic value, being almost the last, certainly the most authoritative, testimony following Hartlaub, as bearing witness to the extreme rarity, if not total extermination, of the bird in question. My quotation is that contained in Pollen and Van Dam's volume, p. 104:—

"*Fregilupus madagascariensis*.—"Cette espèce est devenu tellement rare à la Réunion qu'on n'en a pas entendu parler depuis une dizaine d'années. Elle a été détruite dans toutes les parties du littoral, même dans celles des montagnes peu éloignées de la côte. Des personnes dignes de foi m'ont cependant assuré qu'elle doit encore exister dans les forêts de l'intérieur près de Saint-Joseph. Les vieux créoles que j'ai consultés à ce sujet me disaient que, dans leur jeunesse, ces oiseaux étaient encore communs et qu'ils étaient tellement stupides qu'on les pouvait tuer à coup de bâton. Les créoles de l'île donnent le nom de Huppe. Ce n'est donc pas à tort qu'un habitant distingué de l'île de la Réunion, M. A. Legras, s'exprimait sur cet oiseau dans les termes suivants:—"La Huppe est devenue tellement rare qu'à peine nous en avons vu une douzaine dans nos pérégrinations à la découverte des oiseaux; nous avons même eu la douleur d'en chercher vainement un spécimen dans notre Musée."

† Handleidung der Dierkunde (1857), p. 338.

every other. It is, besides, unobjectionable, while both '*capensis*' and *madagascariensis* are misleading; for I do not believe the bird ever occurred either at the Cape or in Madagascar—most likely not even in Mauritius or anywhere else but Réunion (*olim* Bourbon). The Cape locality seems to be in part due to a mistake of De Montbeillard fostered by Levaillant, who, in such a matter, is universally and properly discredited; and as for its being found in Madagascar, that notion, I believe, arises from a wrong identification by many authors of Flacourt's 'Tiuouch,' which would appear to be a real *Upupa*." "There seems no reason why this should not have been the *Upupa marginata* of Peters, if, indeed, that be distinct from *U. epops*."

The several generic and specific names heretofore adopted by ornithologists are regarded by all as synonymous, subsequent writers choosing that most suitable to their views. There is one exception, however, which I cannot pass in silence. Dr. Vinson, in his paper "De l'Acclimation à l'île de la Réunion," only trippingly alludes to the disappearance of the bird in question from the island; but he nevertheless transmutes its scientific cognomen into *Fregilupus borbonicus*, appending his reasons in a footnote, which I give below in full*. Prof. Giebel, however, in the last issue of his in many ways valuable 'Thesaurus'†, improves the aspect of matters. Under the genus *Fregilupus* two species are duly recorded:—(1) *F. borbonicus*, Vinson; (2) *F. varius*, Gray. This slip is barely excusable in one whose erudition and knowledge of nomenclature should have guided him otherwise. Though possibly justified by supposed better reasons, Sundevall's recent change of generic title into *Lophosarus*‡ (= Crested Starling) is likewise, I think, not entitled to recognition. Although it may be judicious that future names should have proper derivation and be well compounded, yet, if we are pedantically to root up all acknowledged landmarks, we may be lost in the surf-confusion of terms already too numerous. Moreover we should not lose sight of the intermediate forms every day encroaching upon and demolishing supposititious boundaries not to be girded by mere names.

THE SALIENT POINTS OF THE SKELETON.

Sterno-costal framework.—The lateral laminæ of the double-notched breast-bone are delicate and transparent; the keel, rostrum, xiphoid bars, and edges of the rest of the bone thicker and more solidified. The notches are fair-sized, the bars only of moderate strength, but very distinctly pedate, and a grade shorter than the mid sternum. The latter is broadish, and abruptly truncate posteriorly. The inferior margin of the keel is straight, its anterior border widely bayed, the lower termination being more angular than

* "C'est à dessein que je spécifie la huppe de l'île Bourbon sous le nom de *Fregilupus borbonicus*. On ne saurait lui donner avec Reichen [Reichenbach?], le nom de *madagascariensis*, puis qu'elle n'a jamais été trouvée à Madagascar, ni avec Gmelin, celui de *capensis*, puis que Levaillant affirme qu'elle n'existe pas au cap de Bonne Espérance. Donc c'est l'épithète *borbonicus*, qui seule lui convient." (Bull. Soc. Acclim. 1868, tom. v. p. 627.)

† Vol. ii. 1874, p. 192.

‡ Försök till Fogelklassens (Stockholm, 1872), p. 40.

rounded. The rostrum is sharply upturned, and terminally widely forked; the costal processes are both broad and high. Within, the sternum is shallow and widish.

There is a large inflected interclavicle; and whilst the narrowly U-shaped furcular limbs throughout are slender, their upper ends are outspread. The shaft of the coracoid is rounded, long, and not thick, its lower sternal end broadening gradually with an outer, thinned, sharp margin; its scapular extremity with a moderate expansion. The scapula is sabre-shaped and of medium width.

On each side there are only seven vertebral ribs extant in the specimen; but, from appearances, I surmise that there has been an additional riblet anteriorly. The five front ribs have recurrent processes; in the hindermost *two* there are none. The last rib of all has a delicate spinal end; the first does not reach the sternum; neither does the last, though it is fastened to the sixth. Thus there are only five osseous sternal ribs which articulate with the sterno-costal process, and as many which expand at their upper vertebral angles. In form the thoracic cavity is high behind, the reverse in front, and from side narrow and subcompressed.

Pelvis and Spine.—The pelvis is narrow in front, moderately broad in the middle (postiliac region), and wide at the lower (pubo-ischial) processes. The præ- and postacetabular lengths are subequal, advantage, if any, being in favour of the latter. The anterior iliac blades are considerably deflected; but the rear of the pelvis dorsally is full and convexly depressed. The descending ischial plates have a rather perpendicular set, and at the ischiatic foramen the postilium overhangs considerably. The tenuous pubic rods broaden terminally, and are in apposition with and extend further than the tuberosity of the ischium. The renal excavations are each deeply scooped, and exhibit only a trace of transverse partition.

In the neck there are 11 vertebræ, or 12 if that possibly carrying a riblet be included; in the back 7 or 8 with that anchylosed to the sacrum; of sacral 7 or 8; and of free caudals 8. Expressed in formula: C. 11 (12?), DL. 7 (8?), S. 7 (8?), Cd. 8, = 34 (35?). Neural spines obtain in 2nd, 3rd, 4th, and 5th cervicals. 1st to 4th show single median hæmal spines, absent in those that follow, but reappearing in the 11th. The intermediate cervicals possess inflected plates, which defend the carotid artery. Recurrent spicules commence on the 3rd, and increase in length and strength almost to the hindmost neck-vertebræ. The 1st and 2nd dorsals have barely appreciable neurapophyses; those behind have them well developed. Only three or four of the foremost dorsals have inferior mesial spines. Sacrum with a solid columnar body; ragged-edged perforations mark intertransverse vertebral divisions. The six anterior free caudals are tolerably uniform, the penultimate and pygostyle are more adnate, though not anchylosed.

Cranio-lingual formation.—The bill, *i. e.* premaxillary region to the rear segment or orbitocranium, is nearly as 4 is to 3 in length. The skull generally, both from above and in profile, has a long, narrow wedge-form. The brain-area is only very moderately high, being

indeed rather depressed and broad on the top. The triangular narrowing of the bill, though regular, is decidedly most marked and compressed from the nostrils forwards.

The orange-coloured, horny, mandibular case having been retained on one side, enables me to state that at the apex, above and below, there is faint indication of a terminal, shallow notch; whilst behind there is slight roughening of the free margins, this, however, possibly being due to drying and wear. As far as appearances go, the ends of the mandibles meet together in a point, and it seems the lower horny case has greater depth than the upper. The membranous orifice of the nostril is only 0.15 inch, or 2 lines, in antero-posterior diameter, altogether being a small, low-set, narrow, oval aperture, situated 1.1 inch from the tip of the horn-clad rostrum.

Turning to the bones of the lower base, we observe that the præmaxillæ and palatines coalesce anteriorly, and with shallow concavity. The palate, posteriorly, is open, and only covered by membrane in the fresh state. The inward shelving narrow palatal rods terminate posteriorly in oblique-set outer plates, whose free ends are emarginate, with short, rounded, external angles. The inner half-twisted and vertically directed palatal laminæ reach considerably further back, and run beneath the pterygoid abutment, leaving, however, a middle cleft of medium width and depth. The fair-sized vomer is cleft behind, truncate in front; and the septum narium is apparently unossified. The maxillo-palatine of the one side was injured; but in the other I made it out to be a narrow pedicle directed towards the middle and sides of the vomer, not crossing that bone, or united to its fellow of the opposite side. The pterygoids have shafts and ends moderate in their proportions, as is the length of each bone. Posteriorly they possess an upward-directed tabular process lying within the root of the front limb of the quadrate. The jugals are very delicate bony rods, and they lie against the outer lower border of the lachrymals, but not beneath them. As regards the quadrate, it is stout and high, the lower articular knuckles being relatively well pronounced.

The following are the noteworthy points in the shape and disposition of the bones, as examined on the upper posterior and lateral superficies of the cranium. The tapering præmaxillæ have a sensible curvature, narrow, but dorsally rounded, with a slight eminence at rear of nares. There is a prefrontal depression; a tuberos swelling above the foramen magnum, with muscular impressions on either side. This occipital face is widely arched, and smooth beyond. Temporal groove shallow; orbit of moderate circumference; inter-orbital septum with two large fenestræ; lachrymal coalescent with ethmoidal expansion.

I can substantiate what has been averred of the tongue. Fig. 10. Plate LXII., shows its upper surface, along with the hyoid bones. In this specimen it is above an inch long, and seems to have reached quite halfway along the symphysial union when ordinarily at rest in the mouth. It is apparently horny in structure, sagittate in shape, but elongate; the margins slightly raised, so as to produce shallow

grooving. Towards the tip the borders are frayed, and, terminally, slightly forked. The edges of the posterior bifurcation are minutely crenate. Judging from the under aspect, convex and longitudinally furrowed, I believe the muscular structure to have been such that rapid protrusion and withdrawal of the tongue has obtained. With regard to the hyoid bones, each is lengthened and slender; the urohyal is spatulate and tipped with cartilage. The trachea, widest above, tapers very gradually towards the syrinx. Its osseous rings are not simple and uniform, but composed of a series of half-rings, narrow at one extremity and broad at the other; these dovetail with one another in front and behind. What remains of the lower larynx shows it to have been of moderate size.

Limb-construction.—The right leg of this Cambridge skeleton has not been deprived of its integument, which latter, though dried and shrunken, nevertheless exemplifies its scaly character. The tibio-tarsal joint is here sparsely clothed with short feathering, which does not extend beyond the calcaneal elevation. Six scutes cover the tarsus anteriorly, the upper two being much narrower than the three between, which are remarkably long. The three topmost linear divisions are transverse in direction compared with the lowermost, which run obliquely outwards and downwards. Posteriorly the tarsus is smooth, or with a faint appearance of hexagonal scutellation, doubtfully produced by drying of the specimen. The dorsal scutella of the toes are numerous, short, and pronounced. The dermal tracery of the sole of the foot bears a minutely dotted or papillary character.

Both wing- and leg-bones are comparatively strong; but a striking preponderance results in the tibio-tarsal segments, as the subjoined measurements testify:—

	Humerus. in.	Ulna. in.	Meta- carpus. in.	Mid phalanges. in.	Total length. in.
Wing.....	1·5	1·8	1·0	0·6	4·9
	Femur. in.	Tibia. in.	Tarso- metatars. in.	Mid-toe phalanges. in.	Total length. in.
Leg	1·4	2·6	1·8	1·45	7·25

The humerus has a stout, straight, round shaft. Its expanded head has a very large double fossa or divided pneumatic entrance. The inferior inner condylar process is well marked and descends low; a tubercle surmounts the external one. The ulnar shaft is almost devoid of elevations for quill-feathers, but is strong notwithstanding. The radius, on the contrary, is compressed and slender, and its head comes to a level with the outer articular facet of the ulna. Metacarpal and phalangeal pieces are tolerably solid.

Femur characterized by its relative strength, but more particularly by the prominence of its outer inferior condyle and deep groove for tendon behind. As to the tibia, the production of its cnemial crest,

outward sweep and extension of the neighbouring ridge and tubercle, capacity of the femoro-articular facet, large shelf for fibular shaft-abutment, inferior intercondyloid osseous bridge, as well as strength of the entire bone, altogether denote a muscular power of leg adapted to terrestrial more than climbing or perching habit. This limb-strength is likewise well expressed in the tarsus, whose robust triangular shaft is deeply furrowed to accommodate the tendinous cords. The calcaneal eminence is drilled by five foramina. The inferior mid-digital knuckle is largest and longest, the outer laterally compressed, and about equal to the inner, which has an oblique set for the reception of the goodly-sized metatarsal element. The foot has the more usual phalangeal numbers 2, 3, 4, 5, and is $\frac{3}{4}$ -toed, the ungual phalanges being strong and curved. The 2nd and 4th digits are subequal in length, the 3rd considerably longer than either, the 1st or hind toe of medium length, but by far the stoutest of all.

SUPPOSED ALLIANCE TESTED BY THE SKELETON.

With the Upupidæ.—In my communication upon these birds in 'The Ibis' I indicated why, osteologically, *Fregilupus* can no longer be accorded a place among that group. Indeed Levaillant's, Vieillot's, Hartlaub's, and Schlegel's determination, from exterior characteristics alone, are sufficient proof of distinctness from the Hoopoe tribe, and as such accepted by the later classic writers on ornithology. To what I have hitherto stated (*l. c.*), if I add the Passerine feature of multiple calcaneal foramina, the totally different nature of the mandible, notwithstanding its mask of elongation and slenderness, the humerus with its large, bifid pneumatic openings, its round, not flattened, shaft and condylar tubercles, the differentiated distal bones of both wing and leg—then surely such multiplicity of evidence denotes that the skeleton of *Fregilupus* trenchantly recedes from the Hoopoe members, and, as to be shown, correspondingly draws towards the Starling family.

With the Sturnidæ.—The genera of this family, with which I have compared each separate bone side by side with the subject of my paper, are *Sturnus*, *Pastor*, and *Gracula*. Taking these in the order mentioned, that of the Common Starling, *S. vulgaris*, precedes. With this species of *Sturnus*, *Fregilupus* agrees in the general pattern of the sternum; but the former has more delicate xiphoid bars and relatively larger spaces, a deeper keel and longer rostrum, a narrow pointed angular, and not broad rounded scapula. In *Sturnus* the antiliac blades and ischial production are relatively shorter than in *Fregilupus*. With reference to the lower jaw, the type of both is manifestly similar, and in this respect very unlike the preceding groups. The postarticular angle is more acuminate in the Starling, the symphysial, or so-called dentary, region relatively deeper, broader, and shorter than in the Réunion bird. Again, in the cranium both exhibit a certain fulness of brain-region, but wanting the bilobed character of *Upupa*; in the latter the interorbital breadth is great,